The incidence and burden of time loss injury in Australian men's sub-elite football (soccer): A single season prospective cohort study

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Abstract

Objectives

This study aimed to conduct the first injury surveillance study in sub-elite football in Australia, using methods from the international football consensus statement.

Design

Descriptive Epidemiological Study

Methods

1049 sub-elite football players were recruited during the 2016 season. Injury and exposure data was collected by trained Primary Data Collectors (PDCs) who attended every training session and match.

Results

There were 1041 time loss injuries recorded during 52127h of exposure resulting in an injury incidence rate of 20 injuries/1000h (95% Confidence Interval [CI]: 15.9-23.3). The injury burden (days lost to injury relative to exposure) was 228 days lost/1000h. Muscle and ligament injuries were the most prevalent (41% and 26%) and incurred the highest injury burden (83 and 80 days lost/1000h, respectively). The most common injuries were observed at the thigh (22%) and ankle (17%), with hamstring (13%) the highest reported muscle injury. The profile of injury severity was: mild – 35%; minor – 29%; moderate – 28% and severe – 8%. Recurrent injuries accounted for 20% of all injuries.

Conclusion

By addressing issues identified with injury recording in sub-elite football, this study found that the injury incidence was twice that observed in previous research in elite and sub-elite football cohorts. Injury burden was also twice that of the elite setting, with similar injuries associated with the highest burden. The results highlight the need for investment into medical provision,

facilities, coach education and injury mitigation programmes to reduce healthcare costs to sub-elite players in Australia.

Key Words: Sports Medicine, Athletic Injuries, Injury Surveillance, Elite football, Sub-elite football

Introduction

Football (soccer) is Australia's most popular sport with over 1.1 million participants.[1] Below the only professional league (A-League; <1% of all Australian football participants), both

National and regional league competitions include high level sub-elite (semi-professional and amateur) players who participate in three to four scheduled football sessions (training and competition) per week. In addition, sub-elite players are typically committed to other occupational employment or full time education committments which can introduce additional stressors and strains.[2] Despite the high participation rates and player participation profile, there has been no injury surveillance research performed in sub-elite football in Australia. Injury is often the reason a player discontinues sporting participation and can lead to long term disability and substantial medical costs[3] and economic cost associated with employment absences.[4] In alignment with Van Mechelen's injury prevention model,[5] accurate cohort specific surveillance is necessary to inform bespoke injury prevention programmes. Thus, whilst injury prevention programmes can reduce injuries in football by up to 39%,[6] without cohort specific injury surveillance, the effectiveness of injury prevention programmes cannot be accurately determined. [7]

In 2006 a football consensus statement[8] was developed to guide injury research and since publication, the majority of elite football injury surveillance studies have employed the methods as proposed within this statement.[9-11] A number of injury surveillance studies in sub-elite football have stated that the methods used are consistent with the football consensus statement. However, there is often: 1) a lack of detail regarding what injury details are recorded and who collects the data,[12] 2) inconsistencies in the way playing/training exposure is recorded [13] and 3) inconsistent injury definitions used.[14] Meanwhile, due to a lack of resources in the sub-elite setting, studies that have strictly applied the consensus statement methods report difficulties when attempting to record minor (<7 day training/match absence) injuries.[11, 15] Additionally, despite research establishing the importance and value of recording injury burden in the elite setting,[16] injury burden has is yet to be examined in the sub-elite setting. Consequently, the inconsistences and methodological limitations in sub-elite injury surveillance studies make it difficult to compare the incidence and patterns of injury between sub-elite studies and with elite cohorts.[12, 17] Therefore translation of current elite injury prevention practices into sub-elite populations is somewhat limited.[7]

This study aims to: 1) conduct the first injury surveillance study in sub-elite football in Australia, using methods that allow strict adherence to the international football consensus statement[8, 16] and, 2) document injury burden[16] in sub-elite football which has implications for injury prevention strategies and practices.

Methods

A prospective cohort study of 1049 players (age: 24.3 ± 6.2 years; stature: 178.6 ± 6.9 cm; body mass: 75.2 ± 11.2 kg) from 25 male sub-elite football clubs (each comprising ~ 2-3 teams) in New South Wales (Australia) was conducted over the 2016 season. The clubs consisted of four Tier 2 (National Premier League) and twenty-one Tier 3 (Regional League) clubs in which all players received financial incentive to play. Clubs and players were recruited via a number methods including: direct contact with team medical staff; presentations to club officials and coaches; engagement with the regional Association; and contact with State and National Federations. Only players that were considered sub-elite defined as “participating in a *minimum* of 3 scheduled team sessions/week (including 2 training sessions + match day)” were included. Injury records were obtained during all training sessions (2-3 per week) and matches including preseason, in-season and finals (28-34 weeks). Prior to data collection, all players were fully informed of the study and provided signed consent. All procedures were approved by the University of Wollongong’s Ethics Committee (reference number: 15/340).

The football consensus statement[8] injury definitions and data collection procedures (Appendix A) were applied in this study. An injury was defined as “any physical complaint sustained by a player that results from a football match or football training”, whilst time loss injuries were defined as “injury that results in a player being unable to fully participate in matches or training.” As per the football consensus statement, only time loss injuries were included for analysis. Players were deemed to have recovered from injury once they had returned to full training/match participation or were considered eligible for team selection. [8]

A Primary Data Collector (PDC) at each club attended all training and match sessions to record football exposure and injury data via a standardised collection form.[8] Injury and exposure records were shared with the primary researcher on a weekly basis via a customised online data management platform. The use of a Primary Data Collector (PDC) at each club attempted to address the issues identified in performing injury surveillance in sub-elite football.[17] The PDC was designated as the only person collecting injury and exposure data; they attended every training session and were present on match day to facilitate the capture of all injuries. Each PDC was required to obtain a Sports Trainers Level 1 certification, which is considered the national minimum medical qualification in Australia. Sports trainers have been used as PDCs in sub-elite Australian Rules Football injury surveillance [18] and completed additional training with the lead researcher (an accredited physiotherapist) detailing how exposure (minutes) and injury details were to be recorded to comply with the football consensus.[8] The PDC was educated on injury definitions and the process for recording detailed injury descriptions and, as per previous surveillance work,[19] from the injury description, an injury diagnosis was later determined by an accredited physiotherapist using the Orchard Sports Injury Classification System (OSICS-10.1).[20] Additional groin pain subcategories of abdominal, adductor and iliopsoas related origin were added to provide a more in depth analysis of hip/groin pain presentation and to broaden the scope of the injury surveillance, allowing for comparison with recent literature. [21] Injuries that occurred late in the season were followed up by the PDC in order to determine a full recovery date.

Injury incidence rate (± 95% Confidence Intervals [CI]) was calculated (total injuries / total exposure (hrs) x 1000hr), and the mean number of days lost per injury was recorded. Injury burden was calculated as the average number of days lost per injury relative to exposure. [16] The frequency of injuries categorised by type, mechanism and location, are presented as absolute and relative values (percentage of total injuries). If players ceased participation, their individual exposure and injury was still included. Thus, no player data was lost since the injury data was normalized relative to exposure.

Results

A total of 1041 time loss injuries were recorded during 52127 hours (h) of exposure (training = 40327h and matches = 11800h), resulting in a total injury incidence of 20 injuries/1000h (95% CI: 15.9 to 23.3). Matches incurred a 5-fold greater incidence of injuries (54 injuries/1000h; 95% CI: 51.2 to 57.8) versus training (10 injuries/1000h; 95% CI: 8.2 to 11.8). Individual player exposure for matches (11h) and training (39h) over the season resulted in a training exposure to match ratio of 3.6:1. Minimal (7 injuries/1000h; 95% CI: 4.0 to 8.6), mild (5.8 injuries/1000h; 95% CI: 4.2 to 7.1) and moderate injury (5.5 injuries/1000h; 95% CI: 4.7 t0 6.8) severity classification were evenly distributed, and severe injuries (1.7 injuries/1000h; 95% CI: 1.3 to 2.4) were relatively uncommon (Table 1). Injuries affecting the lower limb accounted for 86% of all injuries (Table 1), with the most common locations observed at the thigh (22%) and ankle (18%). The majority (82%; 16 injuries/1000h) of injuries occurred as a result of a specific incident (i.e. trauma) and hamstring injuries (13%) were the most common muscle injury (Table 2).

INSERT TABLE 1 ABOUT HERE

INSERT TABLE 2 ABOUT HERE

An injury burden of 228 days lost/1000h with an average of 11 days lost/injury was observed (Table 3). Muscle and ligament injuries resulted in the highest injury burden (83 and 80 days lost/1000h respectively), with the knee and thigh (53 and 48 days lost/1000h, respectively) the most common locations. Injuries during match exposure resulted in a greater injury burden (160 days lost/1000h) and mean time lost to injury (13 days) when compared to injuries associated with training exposure (68 days lost/1000h; 9 days).

INSERT TABLE 3 ABOUT HERE

Non-contact injuries (136 days lost/1000h) resulted in a greater injury burden compared to contact injuries (92 days lost/1000h). Despite a relatively low injury incidence, knee ligament injuries resulted in a similarly high injury burden (39 days lost/1000h) versus hamstring muscle (38 days lost/1000h) and lateral ankle sprain (33 days lost/1000h) injuries. Recurrent injuries resulted in an injury burden of 50 days lost/1000h and a time lost average of 13 days per injury.

Discussion

In this study, the incidence of injury (20 injuries/1000h) was more than twice that previously reported in elite (8 injuries/1000h)[9] and sub-elite (9.6 injuries/1000h)[11] cohorts. Strict adherence to the consensus statement methods within this study captured a larger percentage of “mild” and “minimal” severity (<7 days’ time lost) injuries compared to previous sub-elite studies,[11, 15] however the relative distribution of injury severity, types, mechanisms and locations were all similar to elite studies.[9, 16] This study was the first to add injury burden to sub-elite injury surveillance. Injury burden was almost twice that of that seen in research conducted in the elite setting,[16] albeit the same injuries (anterior cruciate ligament rupture, hamstring muscle strains, ankle sprains and muscle contusions) were associated with the highest injury burden.

In contrast to previous investigations,[11] the injury incidence in this study was two times greater than that observed in the elite setting,[9] whilst injury burden in the sub-elite setting and was almost twice that observed in the elite setting. [16] Indeed, there are a number of reasons why one might expect differences between sub-elite and elite cohorts that would result in a higher injury incidence and burden. Firstly, a lower training exposure (39h/player) and training to match exposure ratio (3.6:1) was observed versus elite populations (213h/player and 5.2:1, respectively)[9], with matches yielding a higher intensity[23] and injury incidence compared with training sessions.[9, 11] Furthermore, whilst only field based football exposure is included in the football consensus statement, elite teams often perform additional injury prevention and strength and conditioning (S&C) programmes to complement on-field work.[24] As such, the lower training to game ratio, reduced training exposure and a lack of injury prevention and S&C programmes may not provide adequate physical readiness for match intensities in sub-elite football.[25] Therefore, programmes, such as the FIFA11+, that have strong evidence for reducing injury risk in football [6] and can be delivered in the sub-elite setting, may have an important role in addressing these issues.

Secondly, lower player skill levels can present an increased injury risk[26] as these players are less adept at avoiding injury scenarios involving direct contact that commonly result in contusion/haematoma injuries.[27] Indeed, whilst time lost from direct impact injuries in this study was similar to elite football (≤7 days' time loss),[28] an incidence of 3 injuries/1000h for contusion/haematomas was almost three times higher than previously observed in an elite setting (1.3 injuries/1000h).[9] It is thus suggested that the methods adopted in this study, which resulted in a high capture of minor injuries, highlight a potential issue associated with low skill level in sub-elite football. Compounding this, sub-elite teams often play on surfaces with significant signs of wear and tear which can exacerbate the lower skill level,[26] and potentially increase impact injuries and sprains. With respect to the cohort examined within this study, an increased risk of non-contact traumatic injury may also have been observed due to the warmer climate and firmer playing surface characteristics compared with European based sub-elite and elite cohorts. [11,27, 29]

Thirdly, a lack of access to medical staff (e.g. medical doctors, physiotherapists) in sub-elite football likely results in inadequate rehabilitation and return to play decisions that are solely coach and/or player driven, potentially leading to uninformed decisions on safe return to play. The lack of medical staff at training also typically reduces the ability to complete accurate injury reporting.[18] However, the presence of a Sports Trainer at training and on match days to record injury in this study appears to have addressed this issue with a larger capture of injury data compared with previous sub-elite research. It is important to note that, in sub-elite football, it is common for a number of days to pass between scheduled sessions with no player-medical staff contact. Correspondingly, the methods utilised in this study may have overestimated time loss for minimal and mild injuries and presented an inflated incidence.[17] As players were presumed injured until they were able to fully participate in training or a match, in some cases it is possible that there were 3 to 4 days between player-medical contacts, and may have increased time loss periods by 2 to 3 days. However, the effect of any overestimation is difficult to evaluate as an underreporting of injuries has been noted in previous research.[12]

Despite the high injury incidence observed in this study, there were similarities in the injury patterns observed when compared with elite cohorts with muscle injuries incurring the highest injury incidence and injury burden.[9] The time loss (14 days) and relative occurrence (13% of all injuries) of hamstring injury was also similar to elite populations.[30] The impact of hamstring injuries was further highlighted in this study by a burden three and four times higher than calf and quadriceps muscle injuries, respectively. Hip and groin injuries also presented at a similarly high incidence, burden and time loss per injury as the hamstring. The incidence of groin pain was twice that previously reported in elite[31] and two to four times that in sub-elite[11,21] populations. Hip/groin injuries were sub-group classified[21] with a resultant incidence of adductor-related groin pain two times higher than iliopsoas-related, and ten times higher than abdominal-related groin pain, and a similar distribution to existing elite[31] and sub-elite research.[21] Adductor-related injury burden (13 days lost/1000h) was similar to a recent elite cohort study[31] despite a twofold higher groin injury incidence in this study. Whilst it has been suggested that higher level players are at more risk of hip and groin pain,[31] the results of this study indicate that the prevalence of adductor-related groin pain at both sub-elite and elite levels is similar. These findings reaffirm that thigh and groin muscle injuries represent an injury challenge in both elite and sub-elite football, and suggest that in addition to a focus on thigh and ankle exercises, specific groin related exercises should also be included in injury prevention programmes at the sub-elite level.

Knee and ankle ligament injuries were the most common ligament injuries observed in this study, and is consistent with previous research conducted in the elite setting.[9] Knee ligament sprains were associated with player time loss more than twice that of a muscle injury, contributing to a ligament injury burden similar to muscle injury (80 and 83 days lost/1000h) despite a lower injury incidence. The incidence and burden of ligament injury was also much higher in this cohort of sub-elite footballers when compared to reports in an elite setting. Lateral ankle sprain incidence was five times higher and injury burden 50% greater[10] whilst incidence of anterior cruciate and medial collateral ligament (MCL) was two to three times greater than that observed in an elite setting.[32]

Typically, the cause of all muscle and ligament injuries (82%; 15 injuries/1000h) observed in this study were the result of a specific event (trauma). Trauma was the major cause (69%) of all non-contact injuries and resulted in a higher injury burden (136 days lost/1000h) compared with contact injuries (92 days lost/1000h). Indeed, trauma has been reported as the most common injury mechanism in previous sub-elite research.[11] In contrast, overuse appears more common in an in the elite setting.[9] It should be considered, however, that higher football exposure/player in elite football[9] may result in elite players being more susceptible to overuse injury and better access to medical services may facilitate overuse injury recording.[11] In this current study, recurrent injuries resulted in an injury burden twice that of overuse injuries, despite a similar injury incidence, with the mean days lost similar to that of non-contact and contact injuries. Interestingly, the incidence of recurrent injuries was two-four times higher than previous elite[9] and sub-elite research[11, 15] which we attribute to the increased number of minor (time loss <7 days) injuries captured. Indeed, the majority of injuries (64%) in this study were classified as minor, substantially increasing the number of 'initial' injury events that may be defined as recurrent. Injury recurrence was also 50% higher in this study compared to "top level" UEFA European elite cohorts, but similar to that seen in "high level" (Swedish Premier Division) teams.[15] This difference is likely explained by improved medical resources and larger squad sizes at the "top level".[9, 16] Based on the prevalence and burden of recurrent injuries in sub-elite football, strategies to improve return to play policies are thus required, with the importance of minor injury data capture highlighted in this study.

This study has shown a high injury incidence in sub-elite football; however when considering the results, the limitations of this study should be acknowledged. Firstly, multiple PDCs at multiple clubs collecting the data may have presented a degree of extraneous variability. By conducting extensive training of the PDC cohort however, we aimed to minimize potential reporting differences and this 'interclub' variation would also be equally prevalent in any injury surveillance research involving multiple practitioners.[12]

Secondly, the football consensus statement defines an injury as "any physical complaint", however only injuries which resulted in an inability to participate in training or matches are typically included for analysis.[8] The accumulative nature of overuse injuries though, often leads to players with physical complaints continuing to fully participate in football, suggesting it is likely that overuse injuries account for a much larger injury prevalence than reported in this study.[33] Furthermore, accumulated fatigue and injury from participation in other sports, recreational pursuits, and work outside of football is not typically included in elite and sub-elite injury surveillance research, yet may impact on potential injury risk and incidence. Future research should therefore seek to incorporate methods to improve the capture of overuse injuries and non-football related workloads.

Conclusions

In this study a two-fold higher injury incidence and injury burden, and four-fold higher recurrence, was observed when compared to research in the elite and sub-elite setting, yet the location, severity and mechanisms of injury were similar. Conseqeuently, adherence to the procedures outlined in the football consensus statement appears to improve injury surveillance in sub-elite football and should be adopted in future football injury research. The high injury incidence may be related to a number of factors including individual skill level, training availability and access to medical expertise in sub-elite cohorts. Potentially improved coach education on ensuring physical readiness and safe return to play and improved access to medical resources, in addition to the implementation of injury prevention programmes, may all be possible avenues to reduce injury incidence in sub-elite football. Overcoming barriers to, and improving, the implementation of injury prevention and rehabilitation programmes is thus paramount to reducing the incidence and burden of injury in sub-elite football.

Practical Implications

- The addition of a PDC to injury data collection in sub-elite football increases capture of less severe injuries and improves injury surveillance.
- The pattern and severity distribution of injury is similar in elite and sub-elite football.
- The high incidence and burden of injuries emphasises the need to include programmes, such as the FIFA11+, in sub-elite football. Particular focus should be applied to the prevention of knee, ankle and hamstring related injuries due to their associated high injury burden.
- Additional coach education via the coaching curriculum to develop: i) strategies to ensure adequate player preparation, ii) delivery of injury prevention programmes, and iii) return to play policies are warranted.

Competing interests

None declared

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Ethics Approval

University of Wollongong

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Table 1. Injury incidence pattern including location, type and mechanism

	Total	Minimal (1-3 Days)	Mild (4-7 Days)	Moderate (8-28 Days)	Severe (>28 days)
Injury location					
Head/face	33 (3)	16 (4)	8 (3)	7 (2)	2 (2)
Neck/cervical spine	10 (1)	3	2	4 (1)	1 (1)
Shoulder/clavicle	21 (2)	3	7 (2)	6 (2)	5 (6)
Sternum/ribs/upper back	18 (2)	8 (2)	5 (1)	4 (1)	1 (1)
Abdomen	7	2	1	3 (1)	1 (1)
Low back/sacrum/pelvis	34 (3)	19 (5)	9 (3)	5 (2)	1 (1)
Hand/finger/thumb	17 (1)	6	7 (2)	4 (1)	0
Hip/groin	126 (12)	43 (12)	39 (13)	37 (13)	7 (8)
Thigh	231 (22)	62 (17)	68 (22)	79 (27)	22 (25)
Hamstrings	145 (14)	32 (9)	34 (11)	60 (20)	19 (22)
Quadriceps	86 (8)	30 (8)	34 (11)	19 (7)	3 (3)
Knee	167 (16)	57 (16)	46 (15)	45 (16)	19 (22)
Lower leg/Achilles tendon	134 (13)	67 (18)	34 (11)	22 (8)	11 (13)
Ankle	192 (18)	55 (15)	64 (21)	59 (20)	14 (16)
Foot/toe	43 (4)	21 (6)	8 (3)	12 (4)	2 (2)
Injury type					
Fracture	21 (2)	3	2	6 (2)	10 (12)
Other bone injury	12 (1)	4	4 (1)	4 (1)	0
Dislocation/subluxation	19 (2)	2	3	7(2)	6 (7)
Sprain/ligament injury	270 (26)	80 (22)	79 (26)	80 (28)	31 (36)
Meniscus/cartilage	27 (3)	6 (2)	13 (4)	7 (2)	1 (1)
Muscle injury/strain	429 (41)	140 (38)	119 (39)	136 (47)	34 (39)
Tendon injury	54 (5)	21 (6)	20 (7)	12 (4)	1
Haematoma/contusion	160 (15)	86 (24)	45 (15)	25 (9)	4 (5)
Abrasion	6	4 (1)	2	0	0
Laceration	10 (1)	6 (2)	4 (1)	0	0
Concussion	15 (1)	5 (1)	3 (1)	6 (2)	1 (1)
Other injury	20 (2)	5 (1)	9 (3)	5 (5)	1 (1)
Injury mechanism					
Non-contact	599 (58)	184 (31)	179 (30)	184 (31)	52 (8)
Contact	442 (42)	180 (41)	123 (28)	104 (23)	35 (8)
Recurrent	211 (20)	61 (29)	67 (32)	66 (31)	17 (8)
Trauma	853 (82)	283 (33)	236 (28)	250 (30)	84 (9)
Overuse	188 (18)	81 (43)	66 (35)	38 (20)	3 (2)
Total injuries	1041	364 (35)	302 (29)	288 (28)	87 (8)

Values within brackets show percentage of total values (below 1% not shown)
Injury locations and types with <5 injuries are not shown

Table 2. Muscle* and ligament injury incidence pattern, incidence and burden

	Total	Incidence (/1000h)	95% CI	Injury Burden (Days lost/1000h)	Average Days Lost/Injury
Muscle Injury					
Hamstring muscle strain	138 (13)	3	2.4 to 3.4	38	14
Quadriceps muscle strain	43 (4)	1	0.8 to 1.2	8	9
Calf muscle strain	72 (7)	1.4	1.2 to 1.6	12	9
Hip/Groin Pain	102 (10)	2	1.7 to 2.3	21	11
Adductor Related	64 (6)	1.2	1.0 to 1.4	13	11
Iliopsoas Related	32 (3)	0.6	0.5 to 0.7	4	7
Abdominal Related	6 (1)	0.1	0.08 to 0.12	4	32
Recurrent muscle injury	81 (8)	1.6	1.5 to 1.7	20	13
Ligament Sprain					
Knee ligament sprain	82 (8)	1.6	1.4 to 1.8	39	25
ACL sprain	8 (1)	0.13	0.1 to 0.16	17	127
MCL sprain	43 (4)	0.8	0.6 to 0.1	15	18
Ankle ligament sprain	142 (14)	2.8	2.6 to 3.0	33	12

*Muscle injuries only include structural and functional injuries - exclude contusions, haematoma, tendon related injuries. Values within brackets show percentage of total all injuries (n=1041)

Table 3. Injury burden of time loss injuries (injury incidence × mean absence per injury)

	Days Lost per 1000 hours	Days Lost per Injury
Injury location		
Head/face	5	8
Shoulder/clavicle	9	23
Sternum/ribs/upper back	3	8
Low back/sacrum/pelvis	4	6
Hip/groin	25	10
Thigh	48	10
Hamstring	36	13
Quadriceps	12	7
Knee	53	17
Lower leg/Achilles tendon	21	8
Ankle	43	11
Foot/toe	7	8
Injury type		
Fracture	15	37
Sprain/ligament injury	80	16
Meniscus/cartilage	5	10
Muscle injury/strain	83	10
Tendon injury	9	9
Haematoma/contusion	17	6
Concussion	3	11
Dislocation	8	29
Injury mechanism		
Non-contact	136	12
Contact	92	11
Recurrent	51	13
Trauma	203	13
Overuse	25	8
Injury event		
Match	160	13
Training	68	9
Total	228	11